trations required for simple molecular combinations *only* of nitric acid (HNO_3) with water. Some of these combinations have been alluded to by previous writers on this and kindred substances, while others have either not been examined or have formed the subject of a diversity of opinion.

In the case of the densities and contractions the best defined points of alteration correspond to the composition of the hydrates HNO_3 with 14, 7, 4, 3, 1·5, and 1 molecular proportions of water respectively, while in the case of the refractive indices, apart from consideration of density, the most marked points correspond to the 14, 7, and 1·5 hydrates. In the case of the contractions and electric conductivities, but to a less degree in that of the refractive indices, there is remarkable discontinuity at concentrations 95 to 100 per cent., which can possibly be explained rather by some decomposition than by some combination.

Further, the more detailed experiments on the contractions show that these points of discontinuity, though to some degree real, yet to another degree are ideal, in that an apparently abrupt change of events is resolved into either a gradual transition or a transition stage, which differs from either the preceding or successive phase. In the present state of knowledge it appears difficult to interpret the course of events between each phase, as there are the possibilities of at least two cases involving two entities, namely, (i) combined acid and water with free water, and (ii) combined acid and water with free acid.

Investigations into a possible case not readily provided by nature or art, of two liquids which *rapidly* mix but slowly combine each with each, might solve many of the problems of solution towards which the present memoir may serve as a slight contribution.

"The Anatomy and Development of the Stem in the Pteridophyta and Gymnosperms."

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(Abstract.)

Comparatively little attention has been directed to the subject of the development of the stem. This research concerns itself chiefly with the development of the cauline fibro-vascular skeleton, since this appears to be most interesting from the phylogenetic and morphological standpoints. A study of numerous examples drawn from the main groups of the Pteridophyta and Gymnosperms has led to the conclusion that the polystelic type of Van Tieghem does not originate, as he states, by the repeated bifurcation of the epicotyledonary central

cylinder; but that the latter becomes at first a concentric fibro-vascular tube (Bündelrohr of De Bary), with gaps for the branches alone, or with gaps for both leaves and branches.

The tubular nature of the central cylinder in the polystelic type may become subsequently disguised by the overlapping of the gaps and by the appearance of medullary strands, derived in all the cases investigated by the writer from the inner wall of the stelar tube. It seems better to describe these conditions as adelosiphonic instead of polystelic, since the latter term implies a misconception.

In the Osmundaceæ the writer believes he has found evidence of the derivation of the medullated monostelic and astelic types from the siphonostelic condition with internal phloem by the degeneration of the latter.

Osmunda cinnamomea shows all stages between the polystelic and astelic conditions; *O. regalis* still retains occasionally a brown sclerenchymatous pith, while in *O. claytoniana* this phenomenon is quite absent. Similar examples of degeneracy are found among the Polypodiaceæ. Potonié further believes that the so-called medullated monostelic central cylinder of the Gymnosperms is derived by degeneracy of the internal phloem from such types as *Medullosa*. The writer considers that there is good evidence for regarding the so-called medullated monostelic type of central cylinder as derived by specialisation, accompanied by degeneracy, from the so-called polystelic type of Van Tieghem, and thus returns to the conception of the morphology of fibro-vascular strands set forth in De Bary's 'Comparative Anatomy.'

The study of the development of the fibro-vascular skeleton of the higher plants seems to lead to the conclusion that is hardly less important phylogenetically than the osseous skeleton has proved to be in the case of vertebrated animals. Where the tubular central cylinder exists there are two main types, the phyllosiphonic, where foliar gaps are constantly present, and the cladosiphonic, where foliar gaps are equally constantly absent. The central cylinder of the Filicales, Gymnosperms, and Angiosperms belongs to the former type, and that of the Lycopodiales and Equisetales to the latter. These distinctions appear to be of special importance, on account of the absence of constant and far-reaching criteria of taxonomy among the vascular plants. They moreover agree closely with evidence drawn from other available sources.

The writer is of opinion that there are two great primitive stocks of vascular plants, the Lycopsida and the Pteropsida. The Lycopsida include the Lycopodiales and Equisetales, and are palingenetically microphyllous and cladosiphonic. The Pteropsida include the Filicales and Phænogams, which are primitively megaphyllous and phyllosiphonic.